Table III. Effect of volume on endovascular aneurysm repair (EVAR) outcomes by physician specialty

	Interventional radiologist	*Interventional cardiologist*	*General surgeon*	*Cardiothoracic surgeon*	*Vascular surgeon*	
Variable	*Low volume*	*Low volume*	*Low volume*	*Low volume*	*Low volume*	*High volume*
Bleeding, %	4.6	2.8	1.9	3.1	3.7	2.9
Stroke, %	0.3	0.0	0.0	3.1	0.3	0.1
Cardiac, %	1.6	1.4	0.0	9.4	2.0	2.1
Respiratory, %	0.0	0.0	0.0	0.0	0.6	0.1
Vascular, %	0.3	0.7	0.0	3.1	1.0	0.7
SSI, %	0.3	0.0	0.0	0.0	0.4	0.1
Other, %	1.3	0.0	0.0	0.0	0.8	0.5
Length of stay, days	4.0 ± 4.9	3.2 ± 3.5	4.5 ± 10.6	5.4 ± 7.0	3.8 ± 7.6	3.5 ± 2.0
Costs	$32,858	$33,599	$33,274	$25,801	$32,130	$31,950
Mortality, %	1.3	0.7	7.4	6.3	2.4	2.7

SSI, Surgical site infection.

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Endovascular Repair of Ruptured Abdominal Aortic Aneurysms Does Not Independently Reduce Long-Term Mortality Compared With Open Repair

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Objectives: Endovascular repair (EVAR) of ruptured abdominal aortic aneurysms (RAAAs) reduces in-hospital mortality compared with open repair (OR) but it is unknown whether EVAR reduces long-term mortality. We hypothesized that EVAR of RAAA would independently reduce long-term mortality compared with OR.

Methods: The Vascular Quality Initiative (VQI) database (2003-2013) was used to determine Kaplan-Meier 1-year and 5-year mortality after EVAR and OR of RAAA. Multivariate analysis was performed to identify patient and operative characteristics associated with mortality at 1 and 5 years after RAAA repair.

Results: Among 590 patients who underwent EVAR and 692 patients who underwent OR of RAAA, the lower mortality seen in-hospital after EVAR (EVAR: 23% vs OR: 35%; $P < .001$) persisted at 1 year (EVAR: 34% vs OR: 42%; $P = .001$) and 5 years (EVAR: 50% vs OR: 58%; $P = .003$; Fig) after repair. After adjusting for patient and operative characteristics, EVAR did not independently reduce mortality at 1 year (hazard ratio [HR], 0.88 [95% confidence interval, 0.7-1.1]) or 5 years (HR, 0.95 [.77-1.2]) compared with OR. Women (HR, 1.3 [1.04-1.6]), age (HR, 1.06 [1.05-1.08] per 5 years), home oxygen use (HR, 1.9 [1.3-2.7]), dialysis-dependence (HR, 3.9 [1.8-8.6]), cardiac ejection fraction <50% (HR, 1.5 [1.03-2.1]), as well as preoperative systolic blood pressure <90 mm Hg (HR, 1.4 [1.1-1.8]), loss of consciousness (HR, 1.7 [1.3-2.2]), and cardiac arrest (HR, 3.4 [2.5-4.5]) on admission predicted mortality at 1 and 5 years after RAAA repair. Type I endoleak (HR, 2.2 [1.2-3.8]) also predicted mortality at 1 year.

Conclusions: EVAR does not independently reduce long-term mortality compared with OR. Patient comorbidities and indices of shock on admission are the primary independent determinants of long-term mortality. However, the lower early mortality observed in the VQI for patients selected to undergo EVAR of RAAA compared with patients selected for OR is sustained over time, supporting the use of EVAR for RAAA in appropriate candidates. Better elucidation of the key selection factors, including aneurysm anatomy, is needed to best select patients for EVAR and OR in order to reduce long-term mortality.

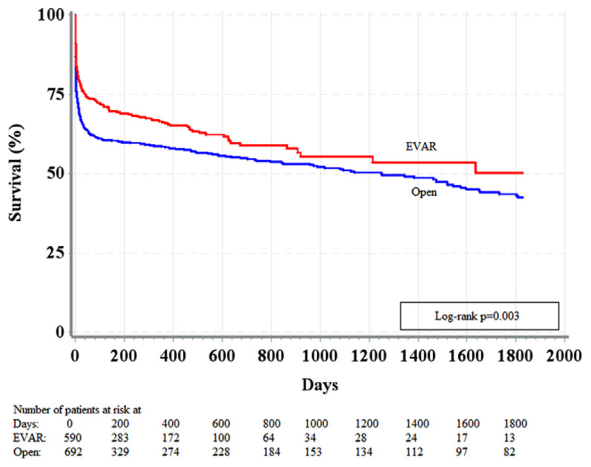

Fig. Long-term survival after open and endovascular repair of ruptured abdominal aortic aneurysm.

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Abdominal Aortic Aneurysm Anatomic Severity Grading Score Predicts Aortic Branch Vessel Complications, Nonaortic Adverse Events, and Survival

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Objectives: Our aim was to examine the predictive value of the Anatomic Severity Grading (ASG) score on aortic branch vessel complications, nonaortic adverse events, and survival.

Methods: Using three-dimensional reconstruction of preoperative computed tomography angiography imaging (TeraRecon; Aquarius iNtuition Workstation, Foster City, Calif), we retrospectively reviewed endovascular aneurysm repairs (EVARs) from 2009 to 2012. Two independent patient groups were created based on ASG score: <14 (low-score group) and ≥14 (high-score group). Aortic branch vessel complications, nonaortic adverse events, and survival were collected and analyzed in relation to ASG score.

Results: We analyzed 218 patients. Mean age was 74 years (range, 48-92), 75% were male and 83% were Caucasian; 114 were in the low-score group and 104 were in the high-score group. Excluding age, there were no other differences in demographics between groups. There were 17 patients with 30-day aortic branch vessel complications: claudication or rest pain (50%), renal insufficiency (39%), and spinal or mesenteric ischemia (11%). The incidence of 30-day branch vessel complications was significantly different between the low-score group (n = 5 [4%]) and the high score group (n = 12 [11%]; $P = .049$). There were 23 patients with 30-day nonaortic adverse events: pulmonary dysfunction (46%), coagulopathy (32%), deep vein thrombosis (DVT; 14%), myocardial infarction (4%), and cerebrovascular accident (CVA; 4%). The incidence of 30-day nonaortic adverse events trended toward statistical significance when analyzing the low-score group (n = 8 [7%]) vs the high-score group (n = 15 [14%]; $P = .075$). When we combined 30-day aortic branch vessel complications with 30-day nonaortic adverse events, we found that the low-score group was statistically different from the high-score group (n = 10 [9%] vs n = 23 [22%]; $P = .006$). After 30 days, 40 patients had midterm aortic branch complications and 41 patients had nonaortic adverse events. After Kaplan-Meier analysis, the freedom from adverse events was statistically different at 1 year (80% vs 71%) and 2 years (79% vs 65%; $P = .006$). Lastly, Kaplan-Meier analysis revealed a significantly longer survival in the low-score group (93% and 90% at 1 and 4 years) vs the high-score group (88% and 80% at 1 and 4 years; $P = .022$).

Conclusions: The abdominal aortic aneurysm ASG score can be used not only to predict operative complexity and reinterventions but also 30-day and midterm aortic branch vessel complications, nonaortic adverse events, and survival.